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ABSTRACT

The pace of technological change, its impact and influence on human behavior, and predictions as to the state of psychotechnology in 1980 are discussed. The author deals with contributions of behavioral scientists working in military and industrial settings toward solving societal problems. Five topics are emphasized. The rate of technological change is gradual, for which a decade is not a long period. Technology of teaching and learning focuses upon two major technological improvements for the next ten years -- better ways to determine what to teach, and individualizing learning. Evaluation and assessment are viewed as having a more prominent role. Psychotechnology of organizations and public policy are the last topics. The author forsees psychotechnology making even more important contributions to societal welfare between 1970 and 1980, since the problem areas are becoming more clearly defined, technologies are developing and much "on the shelf" information is now available for use, and decision makers in greater numbers are coming to understand and accept human goals, human needs, and crucial contributions that behavioral science can make to their fulfillment. Twenty-eight citations comprise a brief bibliography. (Author)

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Psychology in the Real World: A Perspective on Psychotechnology Today and Ten Years Hence

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The Human Resources Research Organization (HumRRO) is a nonprofit corporation established in 1969 to conduct research in the field of training and education. It is a continuation of The George Washington University Human Resources Research Office. HumRRO's general purpose is to improve human performance, particularly in organizational settings, through behavioral and social science research, development and consultation.

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The pace of technological change, its impact and influence on human behavior, and predictions as to the state of psychotechnology in 1980 are discussed. The author deals with contributions of behavioral scientists working in military and industrial settings toward solving societal problems. Topics emphasized include the technology of teaching and learning, organizational processes and the design of organizations, and psychotechnology and public policy.

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Prefatory Note

This paper is based on a presentation at the 78th annual meeting of the American Psychological Association held in Miami Beach, Florida, in September 1970. It was part of a symposium entitled "Psychotechnology and Its Impact on Society: 1970 and 1980."

The chairman of the symposium was Aaron B. Nadel of the U.S. Air Force Human Resources Laboratory. Participants were Wayne H. Holtzman, University of Texas; George E. Briggs, Ohio State University; the author of this paper, William A. McClelland, Human Resources Research Organization; Harry C. Triandis, University of Illinois; John G. Darley, University of Minnesota. The discussant was Davis B. Bobrow, University of Minnesota.

Dr. McClelland is Executive Vice-President and Secretary of HumRRO, and has been associated with the organization since 1955.

PSYCHOLOGY IN THE REAL WORLD: A PERSPECTIVE ON PSYCHOTECHNOLOGY TODAY AND TEN YEARS HENCE

William A. McClelland

Psychotechnology—1970

Where does psychotechnology—the technology concerned with applying psychological methods and results to the solution of practical problems in fields such as industry and education—stand in 1970? What do psychotechnologists know about the behavior of people working in a real world milieu? What impact do the subtechnologies that have been developed and practiced have upon society?

While educational researchers in school settings have made impressive contributions to psychotechnology in the past 10 years, behavioral scientists working in military and industrial contexts have probably made the most impressive and far-reaching recent contributions (Crawford, 1; Wilkins, 2; Sperling, 3; Uhlaner, 4; Trumbull, 5). There are subtechnologies of systems analysis with a human factors perspective, mass selection and classification techniques, system and equipment design, analysis and engineering of jobs, the design and construction of training and educational programs, the development and use of instructional media, applications of the teaching-learning process, evaluation of proficiency and program assessment, the engineering of team functioning, the improvement of social processes such as leadership and morale, the analysis and design of organizations, and the clinical study and amelioration of the individual's human condition. All have developed from and been refined through research, development, and application undertaken by applied psychologists, particularly those working in real world, defense and industrial settings.

Technological Change

But what of tomorrow? And what of 1980? To forecast, we must have methods and data, as well as knowledge of the process of change. Because today many public and private sponsors of research and development are frequently concerned with applications, many psychologists are involved in dissemination and implementation of research findings and in the utilization of research by-products. I have addressed the matter of effecting change and application elsewhere (6). This concern also has an impact on society, both because it contributes to actual change and because it contributes to our understanding of the change process.

The question of whether society benefits from or is harmed by the subtechnologies developed in the military and industrial world, can be argued, but no single, coherent position is likely to emerge from such a debate. My view, like those of Clark (7) and Crawford (1), is that the achievements of military and industrial psychology are substantial and relevant to the solution of many of today's social problems.

In the BASS report (8) on *Outlook and Needs* in the behavioral and social sciences, the authors indicate that the social scientist, in studying human behavior, attempts to study what is happening, tries to understand the basis of conflict and resistance to change, and tries to develop general scientific principles of human behavior in society.

The impact of such knowledge and understanding upon society depends, first, upon whether it is applied and, second, upon what societal goals the applications serve.

A mechanical analogy that features society as the inert receptacle into which the scientist pours his information and technology is particularly devastating to the psychologist concerned with helping man to manage his affairs with greater rationality. MacArthur (9) has expressed a perspective with which I am more in accord. He emphasizes that research and development creates choices or alternatives for fulfilling national commitments and provides new understanding of the relationships between policy, mission, and technology.

Those of us who have been fascinated by the literature on planned change and the diffusion of innovation know that society does *not* implement all the options available from the efforts of scientists, inventors, and technologists. Those innovations that *are* adopted by man and for man's use tend to be characterized by a long latency. Studies of the pace of technological change (Lynn, 10, and Mansfield, 11) indicate that the adoption rate is accelerating. Lynn reports that the time to translate a basic technical discovery into application in the form of a commercial product or process took about 37 years in the 1880-1919 time span. The time dropped to 24 years in the post-World War I era, and to 16 years since World War II. We have long since come to accept the wisdom of Aron's statement:

> "The essence of a scientific society is change . . . adjustment and social integration have come to require the acceptance of instability." (quoted by Horowitz and Herrnstadt, 12).

Predictions about the rate and kinds of change, however, are fraught with problems of methodology and data. This was well illustrated by the presentations made at the March 1970 symposium assessing the future and policy planning, cosponsored by the Institute of Management Sciences, the World Future Society, and the National Bureau of Standards. The lack of good methods, tools, and data makes a forecast of a technology's impact on society in 1980 a risky proposition. But the stakes are so high that brisk activity can be found in the "futures business" (13).

Psychotechnology—1980

Properly fortified with the knowledge of my own fallibility, and optimistic that no one will be so incited or converted by my prognostications as to check them in 10 years, I shall offer some speculations on the state of psychotechnology in 1980.

(1) The rate of change. What will be the state of psychological technologies and their impact on society in 1980? The less difficult part of the question deals with forecasting the impact on society. Frankly, I doubt that the future effects of developments in psychotechnology are going to be much different from those of today. "Red-hot" technological prospects have a high mortality rate—things don't change that fast in the real world. Those changes that take place tend to be gradual or evolutionary. Ten years is not a long period of time for a subtechnology to develop, to be refined, and to be applied. Look, for example, at the very respectable, multi-decade, life histories of such subtechnologies as educational and training objectives, differential selection testing, and the design of controls and displays, all of which received healthy infusions of concepts, effort, and money from military and industrial psychology.

A recent national report (14) presents a reasonable perspective on the pace of technological change:

> "Our broad conclusion is that the pace of technological change has increased in recent decades and may increase in the future, but a sharp break in the continuity of technical progress has not occurred, nor is it likely to occur in the next decade."

(2) Technology of teaching and learning. While many psychologists with diverse interests have studied the psychology of human learning intensively, it is training

psychologists who have made impressive contributions to the *technological* development of the teaching-learning process. In 1961 Gagne (15) sounded a clarion call to psychotechnologists when he said, in effect, "Forget the learning laboratory as a source of that knowledge and understanding which can be applied. Build instead your own task-oriented technology if you wish to effect meaningful change in learning and performance." For at least 15 years, psychologists interested in improving teaching and learning have been doing exactly that and, in the process, have developed a substantial technology. Research accomplishments have made many enthusiastic converts, sometimes to the embarrassment of the research scientist.

One major goal has been clear for several decades: Instruction *must* be individualized. Developments in educational media and hardware make the achievement of this goal much more likely. The two big technological improvements that will become more commonplace in the next decade will be:

(a) Better ways to determine what to teach, and
(b) Better ways to individualize learning.

This is not a bold prediction, but it reflects my perspective on the diffusion rate of innovation. Change takes time.

The subtechnologies involved in determining the "what" and the "how" of the teaching-learning process are rather well formed today. They will, of course, become more refined, but the big contribution will be increasingly broader adoption in practice.

Finn (16) projected these trends for the 1966 to 1976 time frame:

(a) More systemization of the materials of instruction that will result in a more meaningful tailoring of learning tasks.
(b) More use of sophisticated hardware such as electronic systems and multimedia, multiscreen techniques.
(c) Sophisticated information and retrieval techniques for support of the teaching-learning process.
(d) More standardization of instruction through comprehensive, state-wide educational plans.
(e) A meaningful National Assessment Program.

Certainly, research supported by the federal government will play a leading role in both development and application. The recent report of a Defense Science Board task force charged with forecasting defense technology caused a leading defense scientist (9) to observe that traditional educational and training approaches—formal classrooms, uniform curricula, and standardized schedules of instruction—will be obsolete. They will be replaced by massive central computers with long distance remote terminals for military students at far-flung locations. Learning will be a continuing process and adapted to the individual's speed and state of learning, and to the individual's time schedule or preferred hours of instruction, and will occur wherever the student is located, eliminating the need to transport the student to a school.

More imaginative harnessing of the many capabilities of third and fourth generation computers for support of the teaching-learning process is well illustrated, for example, in the computer-assisted and computer-administered instruction work of Bunderson and Holtzman, Suppes and Atkinson, Alpert and Bitzer, Duncan Hansen, and my HumRRO colleagues, Seidel and Kopstein (17).

There are, however, other psychotechnological developments that may receive even wider adoption and effective use by 1980, because the size of the investment needed is smaller, they require fewer major systemic changes, and they can be adopted in stages since they are divisible. Simulation techniques represent one such innovation (18). Under this subtechnology, I include games, micro-teaching, simulated cross-cultural encounters, miniaturized job sample situations, and the use of devices and simple machines.

Peer instruction will be much more common in 1980. Current HumRRO research under Weingarten's direction is a fine example of the development and use of this subtechnology (19), which is related to the developing public educational practices of using teacher aides and also older students to teach younger ones (20).

Techniques of selecting and organizing course content will be much improved, that is, more relevant to real life performance and better sequenced. This subtechnology is well illustrated in public education by such curricula as *Science, A Process Approach* and *Man, A Course of Study*. HumRRO has been a pioneer in this field with our technique that we call functional context training.

What of the impact on society of these and similar contributions of the psychology of the teaching-learning process? I think that we are aware today of many of the possible pitfalls in their application and that we have the necessary wisdom to avoid them. The computer need not dehumanize the classroom. Machines will not replace people in the process of teaching except in tasks that machines perform best. The instructor will become more a manager of the learning process. Interpersonal skills will be given a more important role in curricula to the degree that they are relevant to task performance. In 1980, the gains of the past 10 years will be broadened, the emphasis on the individual instructor and the individual learner will be heightened, the affective and psychomotor domains will assume greater importance, and the time for continuous learning will be lengthened, all to society's benefit.

(3) Evaluation and assessment. The April 1970 issue of *Review of Educational Research* (21) was devoted to educational evaluation, most assuredly a subtechnology that will be prominent by 1980. Extrapolation from the signs of the sixties make this clear. The *Review* article treats such facets of education and training evaluation as judgmental data on objectives and priorities; curriculum evaluation; instructional evaluation; measurement techniques; and the evaluation of social action programs in education. Levitan and Mangum (22) perform a valuable function in describing and assessing *Federal Training and Work Programs in the Sixties.* I foresee marked improvements by 1980 in assessment and measurement techniques that are of necessity brought into a sharper focus through increasing adoption of a general systems orientation to curriculum and individual proficiency development. While much more must be learned about educational and training evaluation, the authors of the *Review* volume (21) are cautiously optimistic. So am I. Again I see society benefiting from better answers to the question, "Were the goals achieved?"

(4) Organizational processes and the design of organizations. Clearly, a new and vital area of interest has been developing that involves an interdisciplinary, systems-oriented approach to the performance of individuals and groups in organizational settings.

I am not at all sure, however, that 1980 will see a well-developed subtechnology of organization. In my somewhat pessimistic view, I am strongly influenced by Bennis' article in the *American Psychologist* (23). The gaps between his own persuasive formulations about organizational development and their application in the campus turmoil of 1970 are painfully documented therein.

In my own organization there is considerable activity that should contribute to the psychotechnology of organizations. Jacobs' comprehensive review of the leadership research literature from an exchange theory perspective should prove to be an invaluable contribution (24). Olmstead's (25) studies of command, control, and communication processes in a battalion staff promise insights that, it is hoped, will contribute to better information and understanding of small group processes.

As Bennis (23), the theoretician and the practitioner, has said, new organizational roles must be developed that will enable institutions "to adapt responsively in an exponentially changing social, cultural, political and economic environment." What is required, he feels, is "... the development of a scientific humanism." It would appear

that there are few other places in our society where there exists a greater potential for behavioral and social scientists to bring together information and understanding to permit man to behave more rationally in his own behalf.

(5) Psychotechnology and public policy. Last in my list of prognostications is this: by 1980, psychotechnology will be making increasingly more important contributions to the formulation and execution of public policy. The 1968 report of NAS-NRC Advisory Committee on Government Programs in the Behavioral Sciences (26) contains these relevant statements:

> "The behavioral sciences are . . . an important source of information, analysis and explanation about group and individual behavior, and thus an essential and increasingly relevant instrument of modern government."

If this knowledge is to be effectively used, however, there must exist

> ". . . a strategy for research to give cohesion and purpose to behavioral science activities . . . and to relate them to policy processes and program operations."

What *is* the relationship of psychotechnology to public policy? This is too complex an issue to discuss in this paper, but the contributions or promises of psychotechnology *have* played a role in the past decade in the formulation of such social legislation as the Manpower Development and Training Act, the Elementary and Secondary Education Act, and the Economic Opportunity Act. While the conservatives among us may feel that psychologists really don't know enough about behavior to advise decision makers, most will concede more is known about individual and group behavior than is effectively applied by policy makers and executors.

The current decade is getting off to a lively start for psychology as the APA debates the issue of its corporate posture in public policy matters. In the July 1970 *American Psychologist* (27), we are asked, "Should we change our tax-exempt status?" The current debate centers not on the question, "Do we as behavioral scientists have anything to offer society?" but instead on the mechanisms whereby our knowledge, and, therefore, our influence, can best be offered. As a member of Tyler's Ad Hoc Committee on Public Affairs (28), I "worked through" many of these issues—my own preference is for the posture developed by this committee.

How can psychotechnologists influence public policy? By providing information and understanding about behavior, by continuing and improving the effort to assure effective use of this input, by continuing educational efforts with governmental forces, sponsors, and other potential users, and by selecting problems for study that will aid in the development of the technology and its data base.

Summary

In this paper I have briefly discussed three topics that are relevant to psychotechnology and its impact on society today and a decade hence: past contributions of psychotechnology to real-world problems, forecasting and the change or diffusion process, and some general predictions for psychotechnology—1980. Unless there is a new and tragic change in domestic affairs or an international conflagration in this decade, I foresee psychotechnology making even more important contributions to societal welfare between 1970 and 1980. Why? Because the problem areas are becoming more clearly defined, because the technologies are developing and much "on-the-shelf" information is now available for use, and because decision makers in greater and greater numbers are coming to understand and accept human goals, human needs, and the crucial contributions that behavioral science can make to their fulfillment.

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